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ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Effects of 3 Years' Grazing at Different Intensities on Crested Wheatgrass Lambing Range in Northern New Mexico

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Findings summarized in this paper are from a 3-year experiment in northern New Mexico in which crested wheatgrass was grazed at different intensities by sheep during the lambing season. Though not conclusive because of the short time involved, the results indicate that intensity of grazing for the short spring period where the grass was allowed to grow and mature after grazing was completed had little effect on crested wheatgrass production. However, the stands grazed most heavily were considered to be deteriorating after the 3 years of grazing.

More than 80,000 acres of brush-infested rangeland in northern New Mexico have been plowed and seeded to crested wheatgrass (Agropyron desertorum (Fisch.) Schult.). These seeded ranges are a valuable resource. Not only is their grazing capacity higher than that of nearby unseeded ranges, but they also furnish much needed spring forage.

Crested wheatgrass stands at relatively low elevations now carry a substantial part of the grazing load during spring and early summer. Consequently, rangelands at higher elevations are grazed less heavily at that time, and the native vegetation is given a chance to become more productive.

Crested wheatgrass stands are proving especially valuable for sheep grazing and lambing in the spring. Thousands of sheep are herded onto the stands every year to utilize the succulent, nutritious forage. Little is known, however, about management of crested wheatgrass for lambing and spring grazing by sheep. The general belief is that lambing is a more severe use than grazing alone, but most of the information available has come from regions where environmental conditions are unlike those in New Mexico.

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Methods

Experimental Site

An area in Tank Canyon on the Laguna Seca Allotment of the Santa Fe National Forest, 12 miles north of Lindrith, New Mexico, was seeded to crested wheatgrass in 1950. Before the area was plowed and seeded, it produced mainly big and silver sagebrush (Artemisia tridentata Nutt. and A. cana Pursh), rubber and Douglas rabbitbrush (Chrysothamnus nauseosus (Pall.) Britt.) and (C. viscidiflorus (Hook.) Nutt.), and a sparse understory of herbaceous plants including western wheatgrass (Agropyron smithii Rydb.) and blue grama (Bouteloua gracilis (H.B.K.) Lag.). Pinyon pine (Pinus edulis Engelm.), Rocky Mountain and one-seed junipers (Juniperus scopulorum Sarg. and J. monosperma (Engelm.)

Figure 1.--The experimental site, seeded to crested wheatgrass in 1950, is surrounded by ponderosa pine and juniper.

Sarg.), Gambel oak (Quercus gambelii (Nutt.), and ponderosa pine (Pinus ponderosa Lawson) surround the seeding (fig. 1).

Elevation of the experimental area ranges from 7,500 to 7,800 feet. Annual precipitation averages 16.5 inches. The soil, derived from sandstone and shale, is moderately deep and varies from a silt loam to a clay loam.

Twelve paddocks, 5.0 to 5.2 acres in size, were fenced sheeptight within the seeded area. Water and granulated salt were available to the sheep at all times.

Grazing Treatments

Four grazing intensities, replicated three times, were assigned at random to the paddocks. These intensities were intended to result in average utilization of 90, 75, 60, and 45 percent of crested wheatgrass herbage produced by the end of the grazing season. Rambouillet ewes grazed the paddocks during and after lambing as follows:

1957	May 16 - July 2	(47 days)
1958	May 2 - June 24	(53 days)
1959	May 5 - June 10	(36 days)

Average stocking of the paddocks and resultant utilization of crested wheatgrass during the 3-year experiment are shown in table 1.

Vegetation Measurements

Production of crested wheatgrass was determined by harvesting herbage from four ungrazed plots in each paddock at the end of the grazing season. Protected from grazing by wire cages, the 38.4 square-foot plots were relocated at random each spring prior to

Table 1.--Production of crested wheatgrass on individual paddocks in 1957 and 1960, and changes in production under different grazing intensities

Relative use	Paddock number	Average stocking, 1957-59	Average utilization, 1957-59	Production		Change in production	
				1957	1960		
		Sheepdays/acre	Percent	Pounds/acre		Pounds	Percent
Lightest	7	76	41	1,555	747	-808	-52.0
	5	73	39	1,607	581	-1,026	-63.8
	6	75	37	1,589	609	-908	-61.7
	Average	75	39	1,584	646	-938	-59.2
Next to lightest	1	97	60	1,118	693	-425	-38.0
	10	100	50	1,975	761	-1,214	-61.5
	4	101	48	1,526	694	-832	-54.5
	Average	99	53	1,540	716	-824	-51.3
Next to heaviest	8	112	72	1,927	816	-1,111	-57.7
	11	115	72	1,311	909	-402	-30.7
	9	119	70	1,472	881	-591	-40.1
	Average	115	71	1,570	869	-701	-42.8
Heaviest	2	155	87	1,176	651	-525	-44.6
	3	153	86	1,821	670	-1,151	-63.2
	12	143	79	1,704	812	-892	-52.3
	Average	150	84	1,567	711	-856	-53.4

grazing. Current growth of herbage was clipped at ground level, air dried, and weighed. Yields were measured each year in late June or early July from 1957 through 1960.

Ground cover was measured by the loop method.[2] Records were obtained from two clusters of two transects each in every paddock in 1957 and 1960.

Forage utilization was determined by the ocular-estimate-by-plot method.[3] For this purpose, 100 9.6-square-foot circular plots were randomly located in each paddock 1 or 2 days after the sheep were removed at the end of the grazing period. Utilization of woody plants, as well as crested wheatgrass, was estimated.

To evaluate stand maintenance, 25 plots, 9.6 square feet in size, were randomly located in each paddock and exclosure in July 1960. Crested wheatgrass plants were classified and tallied on each plot according to age and percentage of dead crown.

To determine changes in basal diameter, leaf length, and culm length under the various grazing intensities, 100 crested wheatgrass plants were selected at random in each paddock and measured in July 1957 and 1960. All measurements were made with the foliage held upright and compressed.

Three exclosures adjacent to the paddocks revealed how the vegetation responded when not grazed by sheep.

[2] *Parker, Kenneth W. A method for measuring trend in range condition on National Forest ranges. U.S. Forest Serv., Wash., D.C. (mimeo.), 22 pp., illus. 1951.*

[3] *Pechanec, J. F., and Pickford, G. D. A comparison of some methods used in determining percentage utilization of range grasses. J. Agr. Res. 54: 753-765. 1937.*

Results

Crested Wheatgrass Production

Herbage yields of crested wheatgrass at Tank Canyon varied widely from year to year, mainly in response to winter-spring precipitation (fig. 2). The relationship between precipitation from January through May and herbage yield is indicated by a correlation coefficient of 0.996. Production in 1957, when winter-spring precipitation was high, was nearly four times that in 1959, when precipitation was low:

Year	Production (Pounds per acre)	Precipitation January through May (Inches)
1957	1,565	9.62
1958	1,206	7.64
1959	399	4.00
1960	735	5.18

Though declines in wheatgrass yield from 1957 to 1960 were not the same in all paddocks, there is no indication that grazing intensity influenced them. Yields in the most lightly grazed paddocks decreased 59 percent, whereas those in the most heavily grazed paddocks decreased 53 percent (table 1). These comparisons suggest that reductions in yield resulted from less moisture in 1960 than in 1957, not from grazing.

Stand Maintenance

In July 1960, the number of dead plants per 100 square feet averaged 3.2 in the most heavily grazed paddocks, 1.9 in the most lightly grazed paddocks, and 1.1 inside the exclosures (fig. 3). Except under heaviest grazing, all paddocks met the test of stand maintenance; that is, dead plants were being replaced by an equal or larger number of well-established young plants. Even in paddocks grazed most heavily, young plants almost equaled the number of dead plants.

Weakened plants (plants with more than three-fourths of their crown dead) were 5.4 times as numerous as young plants in the most heavily grazed paddocks. Comparable multiples for other grazing intensities were: 72 percent use--3.2; 53 percent use--1.9; and 39 percent use--1.4. Young plants were most abundant in paddocks that had been grazed the most lightly, and fewest in paddocks that had been grazed the most heavily. The relatively high ratio of dead or dying plants to young

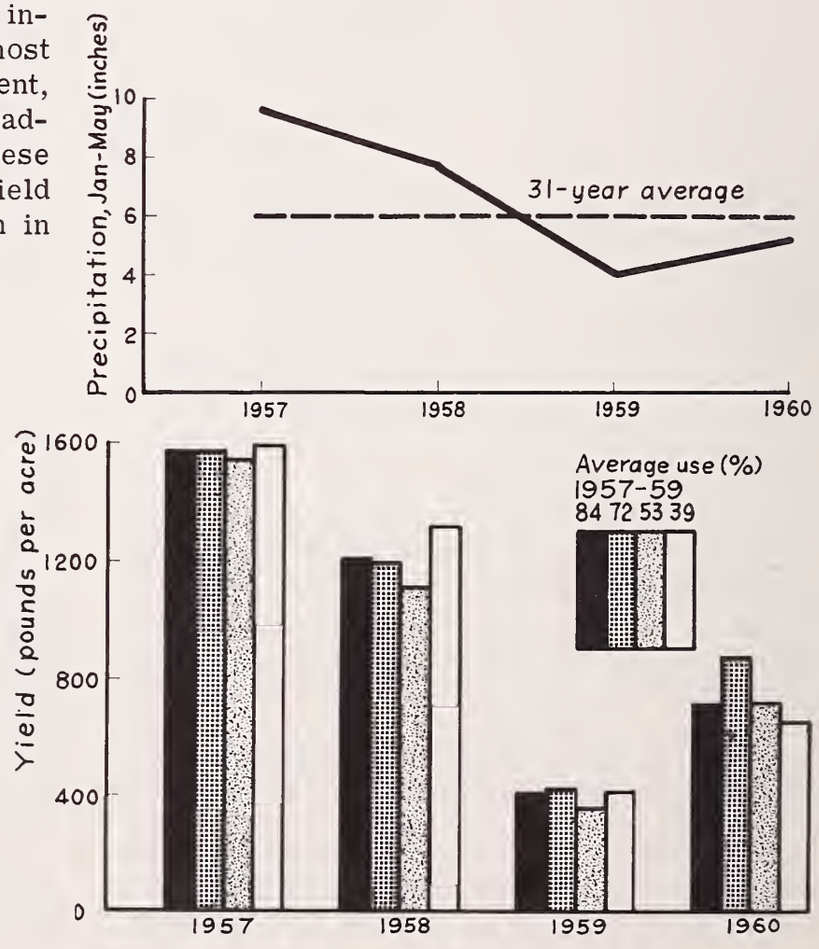

Figure 2.--Crested wheatgrass yields at Tank Canyon from 1957 to 1960 under four intensities of grazing, and different amounts of January through May precipitation.

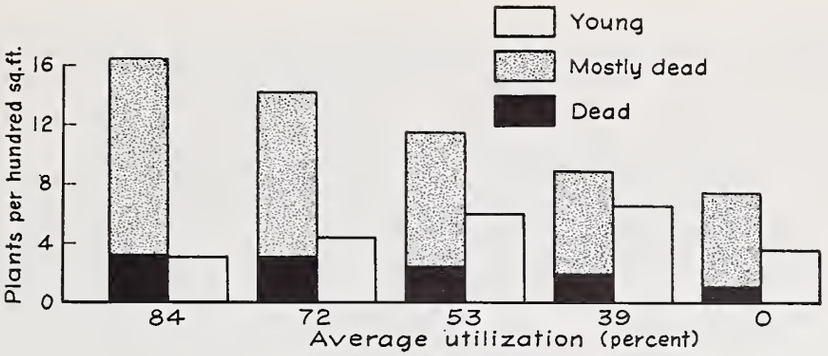

Figure 3.--Number of dead plants, or plants with crown more than three-fourths dead, compared with number of well-established young plants of crested wheatgrass at Tank Canyon in July 1960.

plants in the most heavily grazed paddocks indicates that those stands were deteriorating.

Of special interest is the relative scarcity of young wheatgrass plants inside the exclosures in 1960. Only 3.6 plants per 100 square feet were counted there, compared with 6.5 in the most lightly grazed paddocks, 6.0 and 4.4 in paddocks grazed at intermediate intensities, and 3.1 in paddocks grazed most heavily. Light or moderate grazing apparently favored establishment of young plants.

The unusually dry winter and spring in both 1959 and 1960 may have been partly responsible for the large number of dead or dying plants and the small number of young plants at Tank Canyon in 1960. Precipitation from January through May was only 4.00 inches in 1959 and 5.18 inches in 1960. The long-term average for that period is 5.95 inches.

Table 2.--Average size of crested wheatgrass plants in Tank Canyon paddocks grazed at different intensities, 1957 and 1960

Average utilization (Percent)	Year	Basal diameter	Leaf length	Culm length
			-- Inches --	
39	1957	3.30	14.28	20.42
	1960	2.23	7.41	10.93
53	1957	3.59	14.51	21.01
	1960	2.15	7.07	10.81
72	1957	3.44	13.26	20.02
	1960	1.88	6.96	11.08
84	1957	3.61	14.19	20.31
	1960	1.78	6.09	9.94

Size of Crested Wheatgrass Plants

Plants were much smaller in 1960 than in 1957, irrespective of how closely they had been grazed (table 2). The smaller size probably resulted, first, from less spring moisture in 1960 than in 1957, and second, from fragmentation of plants under grazing.

Differences in size of plants among the different grazing treatments were not great, but the trend was toward smaller plants under heavier grazing (fig. 4). Although basal diameters were about the same in all paddocks in 1957, a trend toward smaller diameters under heavier grazing was evident in 1960. Leaf length showed similar trends. Leaves were longest on the most lightly grazed paddocks and shortest on the most heavily grazed paddocks. Culm length in 1960 was nearly the same in all paddocks except those that had been grazed most heavily where the culms were about 1 inch shorter.

Changes in ground cover during the 3 years of observation were not statistically significant. Nevertheless, the following records indicate that ground cover was considerably less in 1960 where grazing had been heaviest:

Figure 4.--Crested wheatgrass plants in paddock 1 (above), where utilization averaged 60 percent over 3 years, were larger and more vigorous in 1960 than those in paddock 2 (below) where use averaged 88 percent.

	Crested wheatgrass	Litter	Bare soil
	- - (Hits per hundred) - -		
Grazing use:			
None	21.2	33.7	44.2
Lightest	17.3	28.7	52.5
Next to lightest	18.3	20.8	58.9
Next to heaviest	18.6	19.5	60.4
Heaviest	16.2	11.0	71.4

Crested wheatgrass plants occurred at about the same frequency in all grazed paddocks, but were somewhat more abundant inside the exclosures. Litter showed a definite decrease with increased grazing intensity. In paddocks grazed at the heaviest rate, litter was only about half as abundant as in paddocks grazed at intermediate rates and about one-third as abundant as inside the exclosures. Bare soil increased as litter decreased.

Although inconclusive, these findings further indicate that the crested wheatgrass stands were deteriorating under the heavier grazing intensities, particularly where use averaged 84 percent. Utilization of shrubs scattered throughout the crested wheatgrass stands (fig. 5) was proportional to intensity of use of wheatgrass.[4]

[4] *Springfield, H. W. Shrub use by sheep on seeded range. U.S. Forest Serv., Rocky Mountain Forest and Range Exp. Sta. Res. Note 49, 4 pp., illus. 1960.*

Figure 5.-- Appearance of big sagebrush plant in 1960 on paddock where the wheatgrass was utilized at an average of 88 percent from 1957 through 1959.

Summary

1. Crested wheatgrass stands in northern New Mexico were grazed at different intensities by sheep each spring from 1957 through 1959. Ewes were placed in twelve 5-acre paddocks in May just before lambing and kept there 36 to 53 days.

2. Utilization of crested wheatgrass under four stocking rates over the 3-year period averaged 39, 53, 72, and 84 percent, based on weight of herbage produced.

3. Crested wheatgrass can be effectively used as lambing range.

4. Production of wheatgrass apparently was unaffected by intensity of use during the lambing period. This finding must be considered inconclusive, however, because of the short duration of the study. Yields did vary with winter-spring precipitation, however, from about 400 pounds per acre in 1959, a dry year, to 1,565 pounds per acre in 1957 when growing conditions were favorable.

5. Deterioration of stands grazed most heavily was evident in 1960: Dead or dying wheatgrass plants were not being replaced as rapidly by young plants, old plants were smaller, and ground cover was sparse.

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